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ORIGINAL

AUSTRALIA

Patents Act 1990

PROVISIONAL SPECIFICATION FOR THE INVENTION ENTITLED:

Shock Absorber

Name and Address of Applicant: Richard Bugaj, of 14 Lorenzo Crescent, Rosemeadow, New South Wales, 2560, AUSTRALIA

Name of Inventor: Richard Bugaj

This invention is best described in the following statement:

SHOCK ABSORBER

Technical Field

The present invention relates to shock absorbers, and in particular relates to, but is not limited to shock absorbers for motor vehicles.

Background of the Invention

Currently available hydraulic vehicle shock absorbers are most typically of the telescopic type in the form of a single piston and cylinder arrangement used in combination with a coil spring over the shock absorber. A piston rod is connected to the piston within the cylinder with its free end protruding from the cylinder for attachment to the body of the vehicle. The cylinder is attached to the vehicle wheel suspension. Extension or compression of the shock absorber, caused when the wheel suspension passes over a rough surface to elastically deform the coil spring, is damped by resistance to movement of the piston within the oil filled cylinder. The damping resistance to movement of the piston is provided by any of various forms of valve mechanism on the piston which restrict flow of the oil from one side of the piston to the other inside the cylinder.

The damping characteristics of the shock absorber can be adjusted to some degree through adjustment of the piston valve mechanism. Gas shock absorbers are also available which have the same basic structure outlined above, but are further provided with a gas chamber toward the end of the cylinder distal from the piston rod and separated from the oil filled chamber by an axially displaceable dividing piston. The gas pressure in the gas chamber can be adjusted to effect the dampening characteristics of the shock absorber.

These forms of currently available shock absorber suffer from various setbacks including limitations in adjustability to provide precise damping over specific ranges of wheel suspension movement amplitude and duration / frequency. The quality of ride provided by such shock absorbers is also typically compromised against vehicle handling performance.

Object of th Invention

It is the object of the present invention to provide an improved shock absorber.

Summary of the Invention

There is disclosed herein a shock absorber for a vehicle comprising:

first and second axially aligned cylinders each having a liquid filled and sealed piston chamber, an axially displaceable piston received in said piston chamber, and means for dampening axial displacement of said piston through said liquid in said piston chamber,

a piston rod axially extending between and into said first and second cylinder piston chambers, first and second axial ends of said piston rod being connected to said first and second cylinder pistons, respectively, and

means for securing said first and second cylinders to a body and wheel suspension of a vehicle, respectively.

Preferably at least one of said first and second cylinders is provided with a sealed gas chamber at an end thereof distal to said piston rod and a valve for adjusting gas pressure in said gas chamber, said piston and gas chambers being separated by an axially displaceable dividing piston.

More preferably both said first and second cylinders are provided with a said sealed gas chamber and a said gas pressure adjustment means.

Preferably said shock absorber further comprises a sleeve extending between said first and second cylinders, axial ends of said sleeve sealingly engaging said first and second cylinders so as to define a sealed cavity therebetween, said sleeve being axially displaceable with respect to at least one of said first and second cylinders to allow for relative axial displacement of said first and second cylinders, said sleeve being provided with a valve for adjusting gas pressure within said cavity.

Preferably said sleeve is axially displaceable with respect to both of said first and second cylinders.

There is further disclosed herein a shock absorber comprising:

a cylinder having a liquid filled and sealed piston chamber,

first and second axially displaceable pistons received in said sealed piston chamber towards first and second respective ends of said cylinder,

means for dampening axial displacement of each of said first and second pistons through said liquid in said piston chamber,

a first piston rod connected to said first piston and extending through said cylinder first end,

a second piston rod connected to said second piston and extending through said cylinder second end, and.

means for securing said first and second piston rods to a body and wheel suspension of a vehicle, respectively.

Preferably said piston chamber is divided into first and second sub-chambers by a sealed gas chamber, said gas chamber being separated from said first and second piston sub-chambers by axially displaceable dividing pistons, said first and second pistons being received in said first and second piston sub-chambers, respectively, said gas chamber being provided with a valve for adjusting gas pressure in said gas chamber.

Brief Description of the Drawings

Preferred forms of the present invention will now be described by way of example with reference to the accompanying drawings wherein:

Figure 1 is a sectional front elevation view of a shock absorber according to a first embodiment in an extended state.

Figure 2 is a sectional front elevation view of the shock absorber of Figure 1 in a compressed state.

Figure 3 is a sectional front elevation view of a shock absorber according to a modified first embodiment in an extended state.

Figure 4 is a sectional front elevation view of a shock absorber according to a further modified first embodiment in an extended state.

Figure 5 is a sectional front elevation view of a shock absorber according to a second embodiment in an extended state.

Figure 6 is a sectional front elevation view of a shock absorber according to a first embodiment in a compressed state.

Figure 7 is a sectional front elevation view of a shock absorber according to a modified second embodiment in an extended state.

Detailed Description of the Preferred Embodiments

Figures 1 and 2 depict a shock absorber according to a first embodiment in extended and compressed states. The shock absorber is provided with first and second axially aligned cylinders 11, 21. Each of the cylinders is provided with a sealed piston chamber 12, 22 which is filled with oil, hydraulic fluid or any other suitable liquid in the usual manner. Axially displaceable pistons 13, 23 are received in each of the first and second piston chambers 12, 22, along with means for dampening axial displacement of the pistons 13, 23 through the liquid in the respective piston chambers 12, 22.

The dampening means may take any suitable form as are known in the art. A typical dampening means would be a common valve mechanism 14, 24 on the pistons 13, 23 which comprises one or more apertures 14a, 24a passing through the axial extent of the piston 13, 23 and a series of flexible thin plates 14b, 24b secured to the axial ends of the piston which at least partially cover the aperture(s) 14a, 24a to restrict or block the passage of oil therethrough. Deformation of the plates away from the aperture(s) as a result of liquid pressure enables liquid flow through the apertures.

A piston rod 1 axially extends between the first and second cylinders 11, 21 and into the first and second cylinder piston chambers 12, 22. The first and second axial ends 1a, 1b of the piston rod 1 are connected to the first and second cylinder pistons 14, 24, respectively, in the usual manner.

A threaded rod 15 extends from the upper end 11a of the first cylinder distal to the piston rod 1 for securing the first cylinder to a mounting point on the body of a vehicle (not shown) in the usual manner. Other means for securing the first cylinder could also be utilised as required to suit the specific vehicle. A bearing 25 is formed at the distal or lower end 21a of the second cylinder 21 for securing the second cylinder to the wheel

suspension of the vehicle (not shown) in the usual manner. Again the means for securing the second cylinder may be of any form suited to the specific wheel suspension.

The proximal ends 11b, 21b of the cylinders are each provided with an end piece and guide with seal 19, 29 for sealing the end of the pistons chambers at the point of entry of the piston rod 1.

A coil spring can be used with the shock absorber in the usual manner.

The shock absorber according to the first embodiment is thus in the general form of two opposing standard shock absorbers joined by their piston rods. Having two pistons to effect the dampening in a single shock absorber increases the available dampening for a given shock absorber and a reduction by half of the travel of each piston and the piston rod. This provides reduced operating temperatures and an extended life for the shock absorber. Damping can also effectively be provided for even short duration and low amplitude wheel movements.

Whilst in a standard single piston shock absorber the moving piston is directly coupled to the vehicle, the described twin piston shock absorber isolates the moving pistons from both the vehicle body and wheel suspension via the oil within the piston chambers. This isolation, and the reduction in displacement amplitude provides improved level of ride comfort to the occupants of the vehicle.

Having two pistons also provides for adjustment of two valve mechanisms, such that increased adjustment to the damping characteristics can be carried out. Further the valve mechanisms of the two pistons can be adjusted to provide individually different characteristics, tuning the shock absorber to two distinct ranges of wheel vibration / displacement. Such twin range tuning could be particularly beneficial for rally cars which may be subject to rough dirt roads and bitumen within one race stage, requiring different shock absorber characteristics. Separate coils of different stiffness could also be used over each cylinder.

An alternative gas shock absorber form of the first embodiment is depicted in Figure 3. Sealed gas chambers 16, 26 are provided at the distal ends 11a, 21a of the first and second cylinders. Valves 17, 27 are provided in the usual manner for adjusting gas pressure within the gas chambers 16, 26. The gas chambers 16, 26 are separated from the

respective piston chambers 12, 22 by axially displaceable dividing pistons 18, 28 which are free floating and enable the pressure within the gas chamber to be transmitted to the liquid within the piston chambers 12, 22. Rather than both cylinders being provided with the separate gas chamber 16, 26, it is envisaged that only one of the cylinders might have a separate gas chamber 16, 26. It is further envisaged that the gas supply for the gas chambers could be stored externally of the cylinders and communicated with the gas chambers 16, 26 via hose or similar.

Provision of the gas chambers provides the capability for further adjustment of the damping characteristics at each piston and the overall characteristics of the shock absorber.

A further modification of the first embodiment shock absorber is depicted in Figure 4. A sleeve 31 is provided which extends between the first and second cylinders 11, 21. Axial ends 31a, 31b of the sleeve 31 sealingly engage the first and second cylinders 11, 21 so as to define a sealed cavity 32 therebetween. The sleeve ends typically sealingly engage the outer wall of the cylinders via sealing rings 33, 33 which enable the sleeve to be axially displaceable along the outer walls of the cylinders, allowing relative axial displacement of the first and second cylinders 11, 21 during compression and expansion of the shock absorber. It is also envisaged that the sleeve may be fixed to one of the cylinders and axially displaceable with respect to the other so as to still enable expansion and compression of the shock absorber. A detent 34 is provided on each cylinder to ensure the sealing engagement of the sleeve and cylinders is maintained without the sleeve 31 sliding off the end of either cylinder.

Provision of the sleeve 31 improves the lateral stiffness of the shock absorber, and provides further opportunity to adjust the damping characteristics of the shock absorber. Increasing the pressure within the cavity 32 will increase the length of the shock absorber so as to elevate the vehicle if required. The increased pressure will also render the shock absorber harder to compress and easier to extend. A reduced pressure in the cavity will decrease the length of the shock absorber, lowering the vehicle, and making the shock absorber easier to compress and harder to extend.

Figures 5 and 6 depict a second embodiment of a shock absorber in extended and retracted states, respectively. The shock absorber comprises a single cylinder 111 with a liquid filled and sealed piston chamber 112. First and second axially displaceable pistons 113, 123 are received in the sealed piston chamber 112 towards first and second respective ends 111a, 111b of the cylinder. As per the first embodiment, any of various valve mechanisms 114, 124 or other known means may be provided for dampening axial displacement of each of the first and second pistons 113, 123 through the liquid in the piston chamber 112.

A first piston rod 101 is connected to the first piston 113 and extends through the cylinder first end 111a, whilst an equivalent second piston rod 201 is connected to the second piston 123 and extends through the cylinder second end 111b.

The first piston rod 101 is provided with a threaded portion 101a for securing the first piston rod 101 to a mounting point on the body of a vehicle, whilst the second piston rod 201 is provided with a bearing 202 for securing to the wheel suspension of the vehicle. As per the first embodiment, other forms of attachment may be employed as required.

An end piece and guide with seal 19, 29 is provided at each end of the cylinder 111 as per the first embodiment.

A modification of the second embodiment is depicted in Figure 7 which produces a gas shock absorber. The piston chamber is divided into first and second sub-chambers 112a, 112b by a sealed gas chamber 116. The gas chamber 116 is separated from the first and second piston sub-chambers 112a, 112b by axially displaceable dividing pistons 118, 128 in mush the same manner as those of the first embodiment. A valve 117 is provided to enable adjustment of the gas pressure within the gas chamber 116 thereby enabling further adjustment of the damping characteristics of the shock absorber.

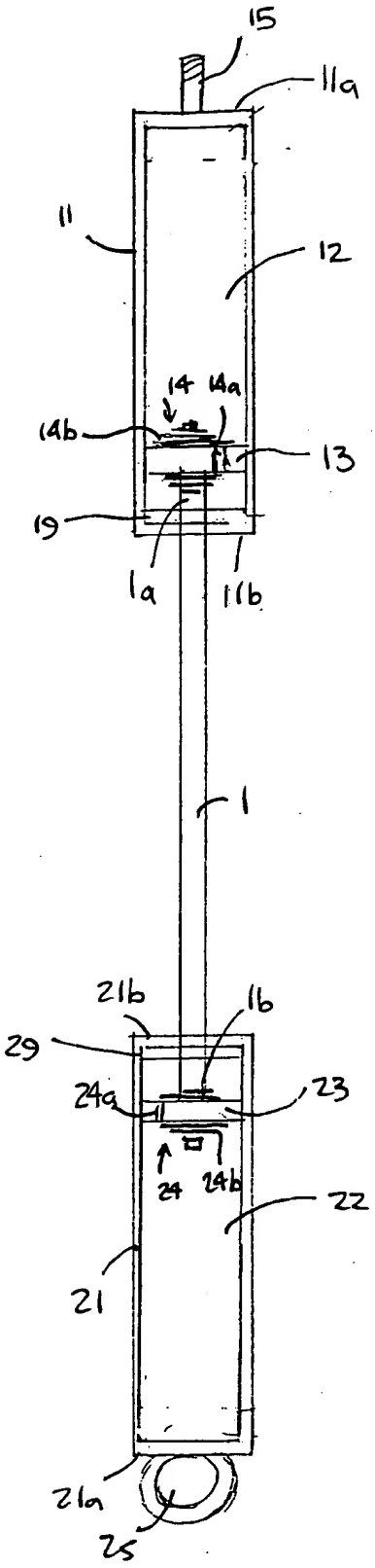
As per the first embodiment, both versions of the second embodiment shock absorber increases the available dampening for a given shock absorber and a reduction by half of the travel of each piston and piston rod with the resultant advantages discussed above. Increased opportunity for adjustment and customising the damping characteristics of the shock absorber are also provided through the piston valve mechanisms and the gas chamber (of the Figure 7 modified embodiment).

DATED this Seventeenth Day of December 1998

Richard Bugaj

Patent Attorneys for the Applicant

SPRUSON & FERGUSON


15
11a
11
12
14
14a
14b
13
19
1a
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21b
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24a
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21a
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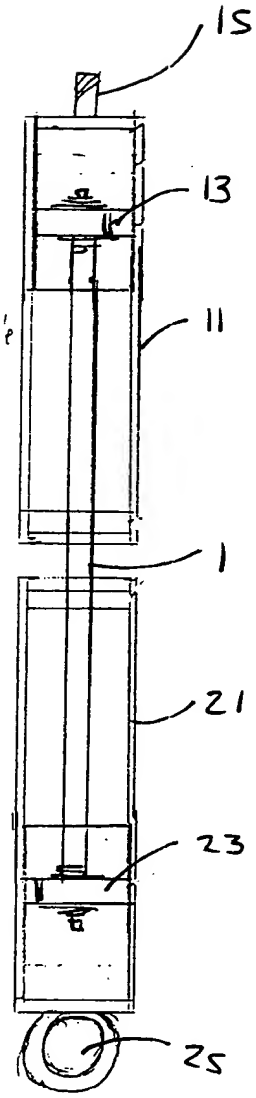
Fig. 1


15
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23
25

Fig. 2

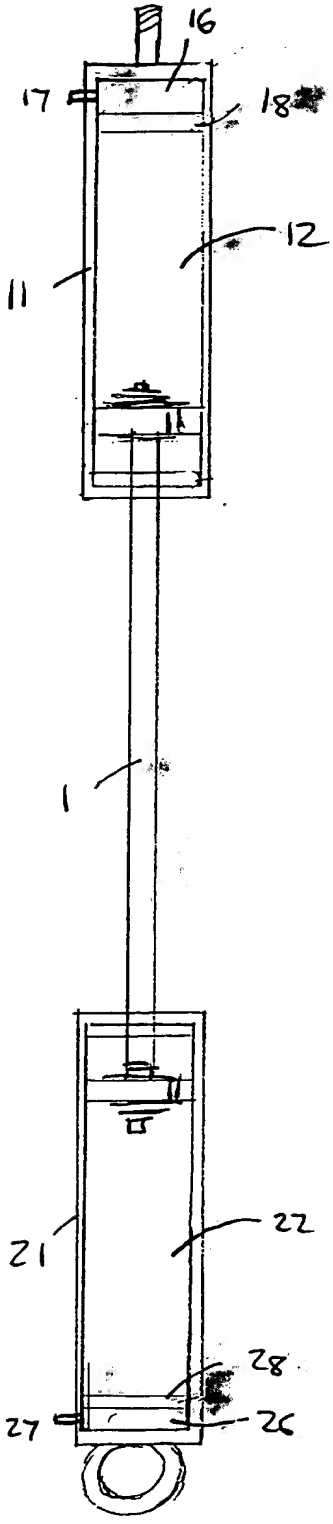


Fig 3

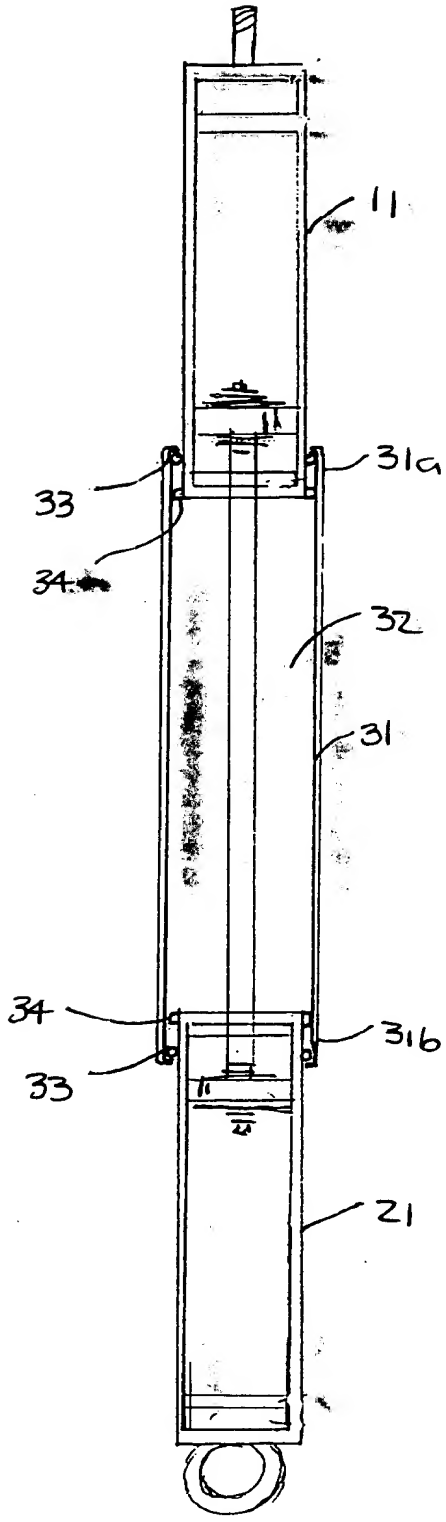


Fig. 4

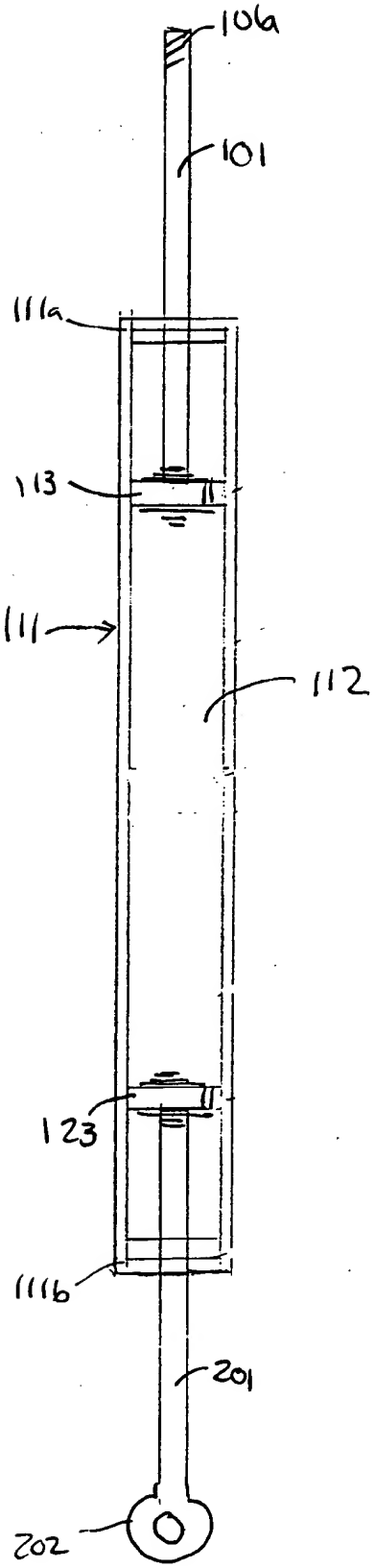
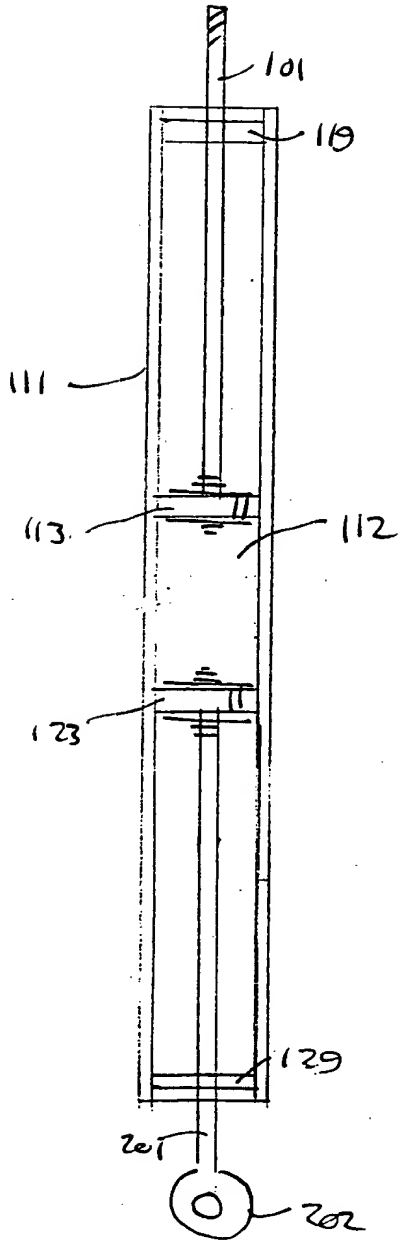

106a
101
111a
113
111
112
123
111b
201
202

Fig. 5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119
111
113
112
123
129
201
202

Fig. 6

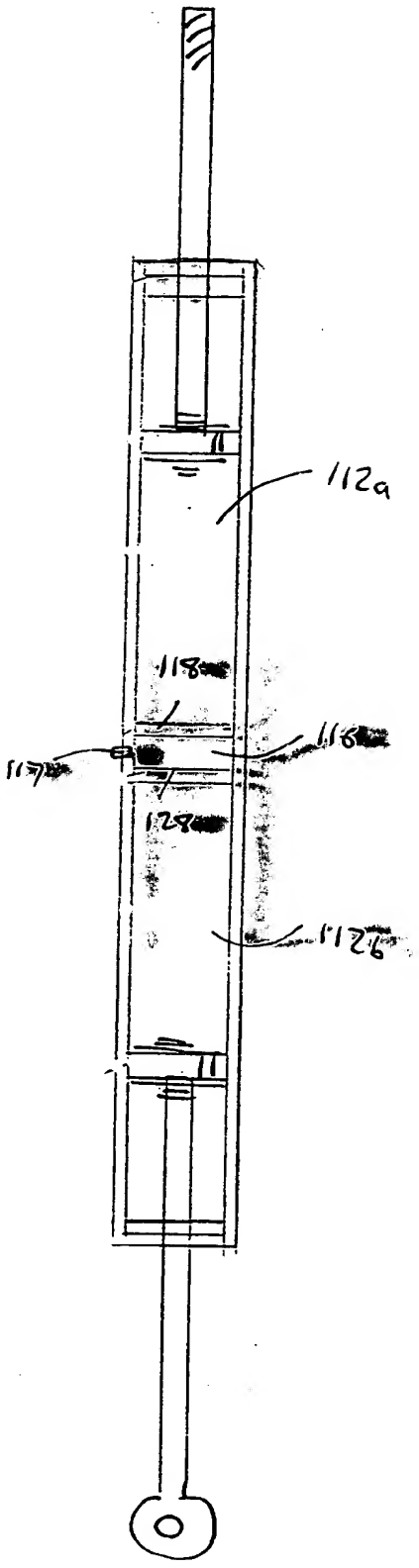

Fig. 7